

## CLAIMS

What is claimed is:

1. A method of optimizing a recording current, comprising:  
measuring a rate of errors under a test condition corresponding to an operating temperature of a hard disk drive, while changing a recording parameter;  
selecting a recording parameter value corresponding to a smallest rate of errors; and  
optimizing the recording current for the hard disk drive under operating environmental conditions using the selected recording parameter value.
2. The method of claim 1, wherein when the test condition corresponds to a low temperature, data is recorded on a target track a predetermined number of times, and the data is read from the target track a predetermined number of times.
3. The method of claim 1, wherein when the test condition corresponds to a room temperature, data is recorded on tracks adjacent to a target track a predetermined number of times,  $N$ , and the data is read from the target track a predetermined number of times.
4. The method of claim 3, wherein when the test condition corresponds to a high temperature, data is recorded on tracks adjacent to a target track a predetermined number of times,  $M$ ,  
wherein  $M > N$ , and the data is read from the target track a predetermined number of times.
5. The method of claim 4, wherein when the test condition corresponds to the high temperature, the measuring of the rate of errors is performed in a data zone selected from each of an inner diameter (ID), a middle diameter (MD), and an outer diameter (OD) of a disk of the hard disk drive, and each recording parameter obtained in each of the respective selected data zones is applied throughout all of the data zones in the respective ID, MD, and OD.
6. The method of claim 1, wherein the recording parameter is an overshoot current (OSC).

7. The method of claim 1, further comprising:  
normalizing a graph illustrating the recording parameter versus rate of errors.
8. The method of claim 7, wherein during normalizing, when there are at least two recording parameter values corresponding to the smallest rate of errors, the method further comprises:  
computing a mean value of the corresponding parameter values.
9. The method of claim 7, wherein the rate of errors is one of a bit error rate (BER) and a channel statistic measurement (CSM).
10. The method of claim 7, wherein the method is performed for at least one recording head and at least one data zone of a disk of the hard disk drive.
11. The method of claim 10, wherein the selected recording parameter values are recorded on a system cylinder of the disk of the hard disk drive.
12. A method of optimizing a recording density of a hard disk drive, comprising:  
measuring a rate of errors in data recorded on a target track under a predetermined adjacent track erasure (ATE) test condition;  
comparing the rate of errors with a predetermined threshold; and  
adjusting the recording density by changing tracks per inch (TPI) when the rate of errors is larger than the predetermined threshold.
13. The method of claim 12, wherein under the predetermined ATE test condition, an overshoot current (OSC) is set to a maximum value.
14. The method of claim 13, wherein the measuring the rate of errors in data recorded on the target track under the predetermined ATE test condition comprises:  
recording data on tracks adjacent to a target track in a first direction, a predetermined number of times;  
reading data from the target track a predetermined number of times; and  
measuring the rate of errors in the read data.

15. The method of claim 14, wherein a number of the tracks adjacent to the target track in the first direction is at least one.

16. The method of claim 14, wherein an error correction capability of the hard disk drive that uses an error-correction code (ECC) is reduced prior to measuring the rate of errors.

17. A method, comprising:  
for a range of operating temperatures for a hard disk drive, measuring a rate of errors for a range of values of a recording parameter;  
selecting and storing the recording parameter value corresponding to a minimum rate of errors for a given operating temperature;  
monitoring the operating temperature during recording to the hard disk drive; and  
employing the stored recording parameter value corresponding to the monitored operating temperature.

18. The method according to claim 17, wherein the range of operating temperatures for the hard disk drive comprises:  
first through third temperature modes.

19. The method according to claim 18, wherein for the first temperature mode, for each recording parameter value, measuring of the rate of errors comprises:  
recording data on a target track a predetermined number of times;  
reading the data from the target track a predetermined number of times each time the data is recorded; and  
measuring the rate of errors.

20. The method according to claim 18, wherein for the second temperature mode, for each recording parameter value, measuring of the rate of errors comprises:  
recording data on tracks adjacent to a target track a first predetermined number of times;  
reading the data from the adjacent tracks a second predetermined number of times each time the data is recorded; and  
measuring the rate of errors.

21. The method according to claim 20, wherein for the third temperature mode, for each recording parameter value, measuring of the rate of errors comprises:

- recording data on tracks adjacent to a target track a third predetermined number of times;
- reading the data from the adjacent tracks a fourth predetermined number of times each time the data is recorded; and
- measuring the rate of errors,

wherein the third predetermined number of times is greater than the first predetermined number of times.

22. The method according to claim 17, wherein when there are at least two recording parameter values that correspond to the minimum rate of errors for the given operating temperature, then the selecting of the recording parameter value comprises:

- normalizing the at least two recording parameter values.

23. The method according to claim 21, wherein the selected parameter value for the third temperature mode is between the selected parameter value for the second temperature mode and the selected parameter value corresponding to the minimum rate of errors for the third temperature mode.

24. The method according to claim 17, wherein:

- the method is performed for at least one recording head and at least one data zone of the hard disk drive;
- the at least one data zone is a representative data zone selected from each of an inner diameter, a middle diameter, and an outer diameter of a disk of the hard disk drive; and
- the parameter values selected for each representative data zone are respectively stored for all data zones in the respective inner, middle, and outer diameters of the disk.

25. The method according to claim 17, wherein the selected recording parameter values are stored in a system cylinder of a disk of the hard disk drive.

26. A method, comprising:

- determining a range of values of a recording parameter for a hard disk drive;
- for at least one recording parameter value in the range,

recording data on a target track a first predetermined number of times,  
recording data on tracks adjacent to a target track a second predetermined  
number of times,

reading the data from the tracks adjacent to the target track a third  
predetermined number of times, and

determining a number of recording errors for the recording parameter value;  
calculating a total of the recording errors for the respective recording parameter values;  
comparing the total to a predetermined threshold;

if the total is greater than the predetermined threshold, setting a recording density of the  
hard disk drive to a first value; and

if the total is not greater than the predetermined threshold, setting the recording density  
of the hard disk drive to a maximized value.